Evaluation of SpectroVisc Q3000 for Viscosity Determination

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EXECUTIVE SUMMARY

The Navy routinely measures the viscosity of lubricating oils and hydraulic fluids. Viscosity measurements typically are conducted in a land based laboratory however the use of a handheld viscometer like the SpectroVisc Q3000 would allow for measurements onboard a Navy vessel. This would reduce the amount of time needed to obtain viscosity measurements and make the process more efficient.

Spectro Inc. furnished NAVAIR (AIR-4.4.6.1) with a SpectroVisc Q3000 handheld viscometer for the purpose of evaluating the accuracy and repeatability of the instrument using Cannon reference standards. Testing was accomplished at the NAVAIR Pensacola FL test facility in accordance with the operating procedures provided by Spectro Inc.

The accuracy and repeatability of the SpectroVisc Q3000 was evaluated using five Cannon reference standards [N10 (10 cSt), N44 (44 cSt), N100 (100 cSt), N250 (250 cSt), and N350 (310 cSt)]. These five reference standards span the reported measuring range of the SpectroVisc Q3000. The viscosity at 40°C of the five standards was determined by measuring each standard 20 times. According to Spectro Inc., the accuracy and repeatability should be $\leq$3%. In addition, the measured viscosities of the Cannon reference standards were compared to the results obtained using an Anton Paar viscometer. The measured viscosities for both instruments should be within 3% of each other.

NAVAIR confirmed the accuracy and repeatability statements made by Spectro Inc. concerning the capabilities of the SpectroVisc Q3000. Both the accuracy and repeatability of the SpectroVisc Q3000 were determined to be less than 3%.

Evaluation of SpectroVisc Q3000 for Viscosity Determination

1.0 BACKGROUND

The Navy routinely measures the viscosity of lubricating oils and hydraulic fluids. Viscosity measurements that are lower than expected indicate a fuel contamination while measurements that are higher than expected indicate water contamination.

Viscosity measurements typically are conducted in a land based laboratory however the use of a handheld viscometer like the SpectroVisc Q3000 would allow for measurements onboard a Navy vessel. This would reduce the amount of time needed to obtain viscosity measurements and make the process more efficient.

Spectro Inc. furnished NAVAIR (AIR-4.4.6.1) with a SpectroVisc Q3000 handheld viscometer for the purpose of evaluating the accuracy and repeatability of the instrument using Cannon reference standards. Testing was accomplished at the NAVAIR Pensacola FL test facility in accordance with the operating procedures provided by Spectro Inc.

2.0 OBJECTIVE

The objective of this testing is to evaluate the SpectroVisc Q3000 instrument for the determination of viscosity at 40°C in lubricating oils and hydraulic fluids.

3.0 APPROACH

The accuracy and repeatability of the SpectroVisc Q3000 was evaluated using five Cannon reference standards [N10 (10 cSt), N44 (44 cSt), N100 (100 cSt), N250 (250 cSt), and N350 (310 cSt)]. These five reference standards span the reported measuring range of the SpectroVisc Q3000. The viscosity at 40°C of the five standards was determined by measuring each standard 20 times. According to Spectro Inc., the accuracy and repeatability should be ≤3%.

The measured viscosities of the Cannon reference standards were compared to the results obtained using an Anton Paar viscometer. The measured viscosities for both instruments should be within 3% of each other.

4.0 DISCUSSION

The viscosity at 40°C was measured 20 times for five Cannon reference standards [N10 (10 cSt), N44 (44 cSt), N100 (100 cSt), N250 (250 cSt), and N350 (310 cSt)] using the SpectroVisc Q3000. Table 1 presents the measured viscosities.

Table 1: Viscosity at 40°C determined using the SpectroVisc Q3000

	Cannon N10 10 cSt	Cannon N44 44 cSt	Cannon N100 100 cSt	Cannon N250 250 cSt	Cannon N350 310 cSt
1	10.2	44.3	98.5	248	304
2	10.1	42.5	99.4	245	304
3	9.9	42.2	98.4	252	301
4	10.0	44.0	95.3	243	303
5	10.0	42.7	99.1	238	300
6	10.0	43.8	96.6	239	306
7	10.1	43.1	97.4	247	307
8	10.0	43.4	98.1	246	307
9	10.1	44.4	97.0	238	311
10	10.0	43.5	100.0	236	314
11	9.9	44.5	101.0	250	314
12	10.0	42.5	97.7	242	306
13	10.0	43.4	100.0	245	302
14	9.9	43.1	97.7	247	305
15	9.9	43.7	99.8	240	303
16	10.0	43.2	98.5	248	300
17	10.1	44.1	98.2	246	310
18	9.9	44.2	97.5	242	306
19	10.0	43.4	99.2	243	304
20	10.0	44.3	98.8	247	305
Average	10.0	43.5	98.4	244	306
Stdev	0.1	0.7	1.3	4	4
%RSD	0.83	1.59	1.36	1.77	1.33

The accuracy and repeatability of the SpectroVisc Q3000 was determined to be ≤3% for all five of the Cannon reference standards.

The viscosity at 40°C was measured 20 times for the same five Cannon reference standards using an Anton Paar viscometer. Table 2 presents the measured viscosities for all five standards on both viscometers.

Table 2: Comparison of Measured Viscosities at 40°C

	Cannon N10		Cannon N44		Cannon N100		Cannon N250		Cannon N350	
	Anton Paar	Q3000	Anton Paar	Q3000	Anton Paar	Q3000	Anton Paar	Q3000	Anton Paar	Q3000
1	10.225	10.2	44.583	44.3	97.582	98.5	250.82	248	312.33	304
2	10.127	10.1	44.529	42.5	97.884	99.4	250.38	245	312.48	304
3	10.120	9.9	44.516	42.2	97.947	98.4	250.98	252	312.58	301
4	10.117	10.0	44.515	44.0	98.033	95.3	250.52	243	312.59	303
5	10.117	10.0	44.514	42.7	98.036	99.1	251.19	238	312.59	300
6	10.118	10.0	44.511	43.8	98.069	96.6	250.09	239	312.70	306
7	10.118	10.1	44.510	43.1	98.086	97.4	250.74	247	312.61	307
8	10.118	10.0	44.510	43.4	98.086	98.1	250.41	246	312.14	307
9	10.121	10.1	44.507	44.4	98.128	97.0	250.94	238	312.45	311
10	10.119	10.0	44.509	43.5	97.796	100.0	250.86	236	312.50	314
11	10.119	9.9	44.509	44.5	98.149	101.0	250.97	250	312.62	314
12	10.122	10.0	44.508	42.5	98.184	97.7	250.97	242	312.55	306
13	10.121	10.0	44.507	43.4	98.149	100.0	251.23	245	312.61	302
14	10.115	9.9	44.513	43.1	98.143	97.7	251.18	247	312.57	305
15	10.115	9.9	44.505	43.7	98.160	99.8	252.60	240	312.69	303
16	10.116	10.0	44.505	43.2	98.095	98.5	252.60	248	312.69	300
17	10.116	10.1	44.513	44.1	98.084	98.2	252.58	246	312.92	310
18	10.116	9.9	44.509	44.2	98.108	97.5	252.93	242	312.66	306
19	10.115	10.0	44.511	43.4	98.122	99.2	251.11	243	312.74	304
20	10.115	10.0	44.509	44.3	98.126	98.8	251.06	247	312.63	305
Average	10.124	10.0	44.515	43.5	98.048	98.4	251.208	244	312.583	306
Stdev	0.024	0.1	0.017	0.7	0.146	1.3	0.812	4	0.159	4
%RSD	0.24	0.83	0.04	1.59	0.15	1.36	0.32	1.77	0.05	1.33

The measured viscosities for both instruments were determined to be within 3% of each other.

5.0 CONCLUSIONS

NAVAIR substantiated the accuracy and repeatability statements made by Spectro Inc. concerning the capabilities of the SpectroVisc Q3000. Both the accuracy and repeatability of the SpectroVisc Q3000 were determined to be less than 3%.

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